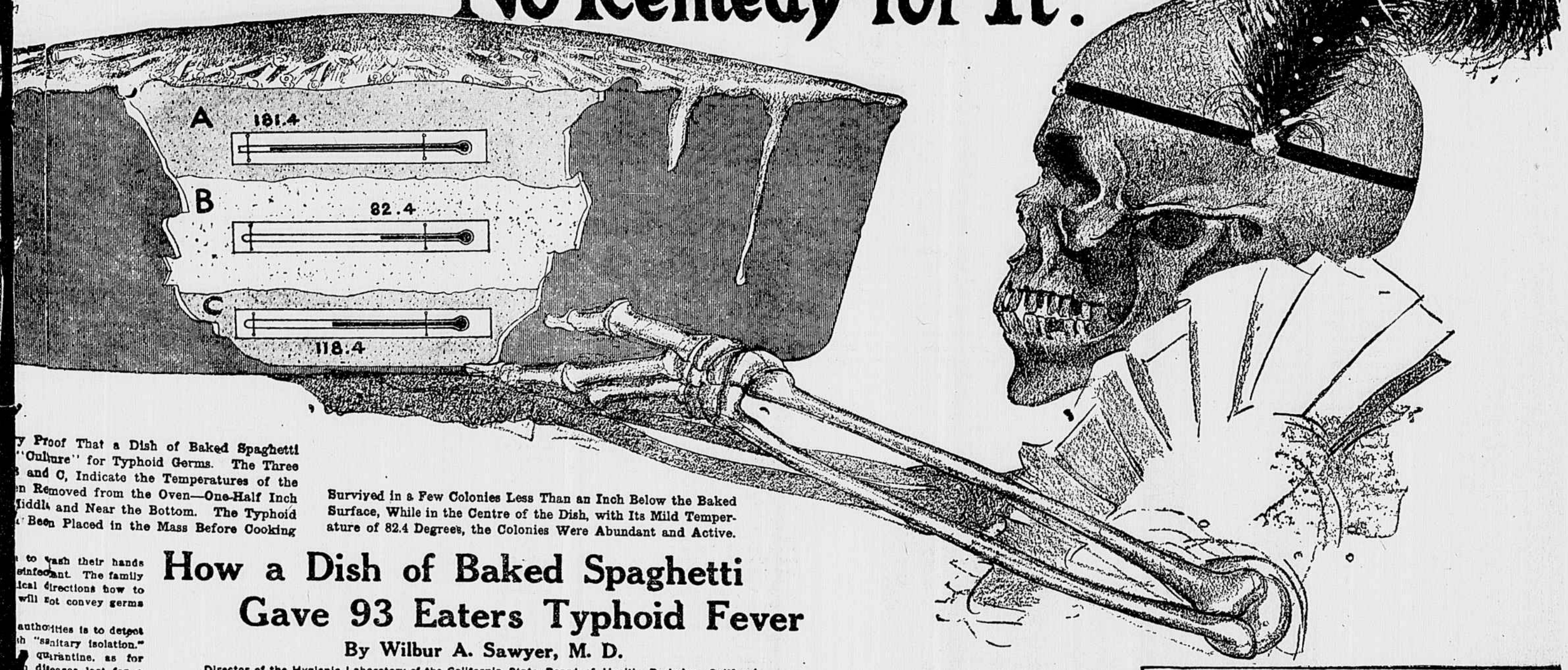
ed Danger to Everybody's Health—and No Remedy for It.



y Proof That a Dish of Baked Spaghetti "Culture" for Typhoid Germs. The Three B and C, Indicate the Temperatures of the n Removed from the Oven—One-Half Inch Middle and Near the Bottom. The Typhoid Been Placed in the Mass Before Cooking Survived in a Few Colonies Less Than an Inch Below the Baked Surface, While in the Centre of the Dish, with Its Mild Temperature of 82.4 Degrees, the Colonies Were Abundant and Active.

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Empowered Carriers

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t quarantine is not sufficient. That is them and to be sure Most people have s soon as the danger ors is explained will ly clean. And all of ell developed can do p the hands of the

How a Dish of Baked Spaghetti Gave 93 Eaters Typhoid Fever

By Wilbur A. Sawyer, M. D.

Director of the Hygienic Laboratory of the California State Board of Health, Berkeley, California.

(From His Official Report of the Case.)

THE City of Hanford, California, experienced an explosive outbreak of typhoid fever in the latter part of March, 1914. The epidemic consisted of ninety-three cases, all of which were traced to a church dinner. The infection came from a typhoid carrier among those who prepared and served the food—a woman who did not suspect that she had ever had typhoid fever.

Of special interest were the incubation periods, which were, in the majority of instances, less than eight days. The shortest was three days.

The disconcerting observation was made during the investigation that under conditions which are not at all unusual, baking can actually incubate the inner portions of masses of food instead of sterilizing them.

The epidemic began with one case on March 20. During the following three days the daily number of new cases rose rapidly to the maximum, nineteen. After that the number fell quickly. The last case developed on April 16.

The total number of cases in the outbreak was ninety-three.

Three of the severe cases resulted in death and several others in serious danger.

A number of persons infected at Hanford travelled considerable distances during the incubation period. This illustrates how typhoid fever is carried into cities which are not responsible for the infection. Two of the ninety-three persons travelled over two hundred miles to San Francisco and developed the disease there. Three of the cases developed in Fresno, thirty miles north of Hanford. Although typhoid fever was conveyed to San Francisco, Fresno, Exeter, Alpaugh, Tulare, Armona and Selma and to ranches in the country around Hanford, no secondary infections from these cases have come to my attention.

Early in the investigation it was definitely determined that the infection came from food served at a public dinner and supper held in a public hall, March 17. All of the ninety-three persons who developed typhoid fever ate food served there. Eighty-five of the patients attended one or both of the meals and received their infection in this way. The other eight were infected from eating food brought to their homes from the hall by friends.

While the infection was easily traced to the public dinner, the source from which the food became infected was at first obscure. Fifty-five of the patients were interviewed and information was obtained from others through their physicians. The facts regarding the kinds of food eaten at the dinner were tabulated and studied.

The dinner was a church dinner partaken of by about 150 persons, about 125 eating at noon and 45 in the evening.

How the Typhoid "Carrier" Was Traced Down

The bill of fare at the noon meal consisted of chicken pie, mashed potatoes, Spanish spaghetti, baked beans, potato salad containing onions and hard boiled eggs and served on lettuce, bread and butter, olives, several kinds of pie, cheese, iced tea and coffee. At the evening meal ice cream and cake were added to the list. Most of the food was donated, and was prepared at various homes or at the hall. Butter, bread and potatoes were bought from stores whose other customers remained well.

Next to the chicken pie the Spanish spaghetti was the dish eaten by the largest number of the persons who became sick. Since the chicken pie was of three or more lots, the spaghetti was the only dish eaten in common by most of the typhoid patients. A few, however, were positive that they had not eaten the spaghetti.

Only a few ate the baked beans. Many did not eat the potato salad. The lettuce leaves on which the salad was served were donated from a private garden, which had been watered with city water and fertilized with horse manure from the barn on the premises. The family had been eating this lettuce and had remained entirely well.

Twenty persons had sufficient connection with the dinner to need special investigation. Sixteen of these were women who were actively engaged in preparing or serving the food.

One member of this group presented a history which made it seem probable that she was a chronic typhoid carrier. Mrs. X had formerly kept a boarding house in Hanford. Seven and a half years before, in October, 1906, one of her twelve or fifteen boarders came down with typhoid fever. The source of his infection was obscure. A week after this case had appeared another man who was boarding with Mrs. X developed typhoid fever. Again the source of infection was not clear. In March, 1912, two more cases appeared in the boarding house of Mrs. X.

This history of four previous cases of typhoid fever among the contacts of Mrs. X made it seem probable that she was a chronic carrier and was the source of infection, not only of the four boarders, but also of the ninety-three persons infected at the dinner on March 17. Later the proof that she was a chronic carrier was received by telegram from the laboratory.

The one article of food with which Mrs. X came in contact before the dinner was the Spanish spaghetti. She had prepared this dish at her home, up to the point of the final baking, which took place at the hall just before the dinner This final baking would appear at first glance to justify the elimination of the spaghetti as the dish responsible for conveying the infection.

How the Typhoid Germs Resisted the Heat

The Spanish spaghetti was prepared as follows: On the day before the dinner the spaghetti was boiled in water. Then it was washed and separated with city water running from a tap. On the same day a Spanish sauce was made out of a quart of milk, two cans of tomatoes, butter, seasoning, cooking soda and the strained liquid in which dried peppers had been boiled. Probably a little flour was added for thickening. These ingredients were put together and cooked.

On the day of the dinner, at about 10 a. m., the spaghetti and the sauce were mixed in a large dishpan and covered with cheese. The weather was warm and would have been conducive to the multiplication of bacteria. The spaghetti arrived at the hall between 10 and 10:30 a. m., and was put into the oven of a gas stove immediately. The late arrival of the spaghetti caused the women to fear that there would not be sufficient time for the proper baking of this important item on the bill of fare. When the first patrons arrived they were served with the upper and warmer layers of the spaghetti, as it was thought that the deeper portions would not be as hot as desired.

The evidence would be strong that the spaghetti carried the infection if it could be shown that this dish was a good culture medium and was not sterilized by the baking. Experiments were therefore undertaken at the State Hygienic Laboratory to clear up these two points.

A dish of Spanish spaghetti was prepared as nearly as possible according to the methods used by Mrs. X. The spaghetti and sauce were prepared separately. Some of the sauce was put in flasks and sterilized and set aside to be tested for its properties as a culture medium. The remainder of the sauce and the spaghetti were inoculated with a broth culture of the typhoid bacillus of the strain from Mrs. X. The following day the sauce and spaghetti were thoroughly mixed in a small dishpan and covered with one pound of grated cheese.

The dish was not as large as the one prepared by Mrs. X, and would therefore be more easily heated through. This mass of Spanish spaghetti was 5 inches deep and ranged from 9 to 13 inches in diameter. The oven of an ordinary gas range was heated to baking temperature, and the dish of spaghetti was put in. After seven minutes the door was opened for an instant and it was noted that the cheese had melted. After fifteen minutes the dish was removed from the oven. The surface was not properly browned, and the temperature in the middle of the spaghetti had risen only one degree above room temperature (60.8 to 62.6 degrees F.) In the following half hour, while the dish was standing in the room, the temperature at the middle rose to 69.8 degrees F., as the heat gradually penetrated to the inner portions. Cultures taken from various depths all developed colonies of typhoid bacilli.

A Tempting Dish Full of Active Germs

A large hot-air sterilizer was then heated and kept between 320 and 338 degrees F. The pan of spaghetti was introduced and subjected to this heat for thirty minutes. When the dish was removed the surface was of a golden brown color. The appearance and aroma suggested that the spaghetti was thoroughly cooked and very hot. The temperature near the top was 129.2 degrees F. and at the middle 73.4 degrees F. Ten minutes later the temperature at the middle was 75.2 degrees F., and the dish was then returned to the oven. Cultures taken at various levels showed that the typhoid bacilli were alive even close to the surface.

In the next baking the over was kept at a temperature ranging between 405 and 417 degrees F. After half an hour the pan was removed. The surface was dark brown, and the points sticking up from it were charred. The liquid around the margin was boiling vigorously and the whole dish was sizzling. The temperature just under the surface was 181.4 degrees F. At the middle it was 82.4 degrees F., and near the bottom it was 118.4 degrees F. An hour later the temperatures had become nearly equalized and were 114.8 degrees F. near the top, 108.5 degrees F. at the middle and 109.4 degrees F. near the bottom. This showed that the interior of the dish did not reach even a pasteurizing temperature.

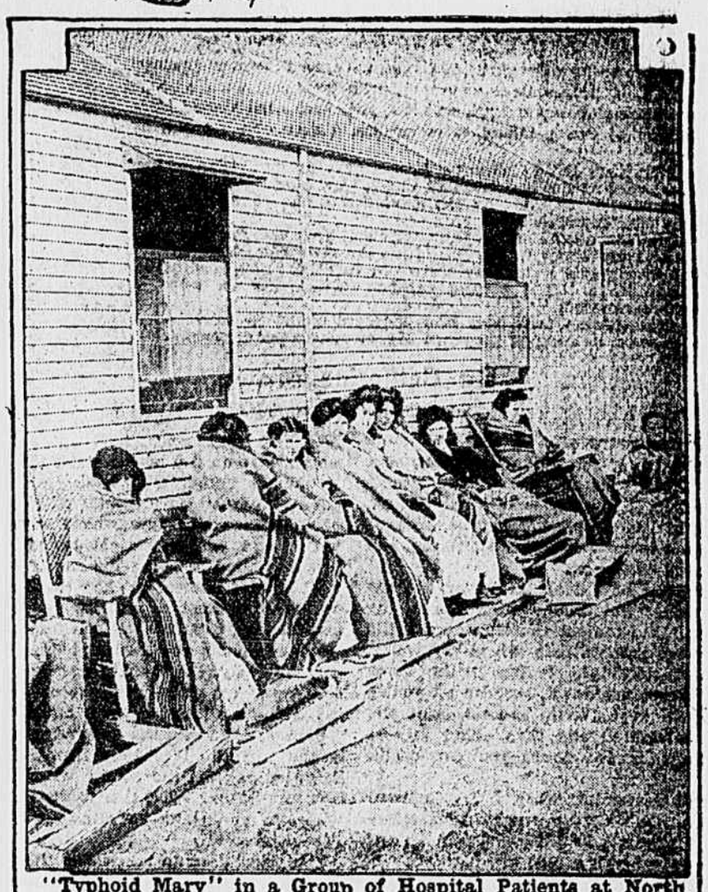
Cultures taken at the surface soon after the pan had been removed from the oven showed no typhoid colonies and very few of the other kinds. Cultures taken at a distance of half an inch from the surface showed a few colonies of the typhoid bacillus, most of the organisms having been killed. Cultures from a depth of two and a half inches showed abundant colonies of typhoid bacilli. In these cultures the typhoid colonies were identified by their appearance on Endo medium and Russell medium and also by agglutination by anti typhoid serum.

In this way it was shown that sterilization of the pan of spaghetti at the dinner in Hanford was not only improbable, but practically impossible. The mass of the spaghetti there was much greater than in the experiment and conditions were less favorable for thorough baking.

The thickened sauce, consisting so largely of milk, was suspected of being the culture medium in which the multiplication of the typhoid bacillus took place. Ten c. c. of the sauce, which had been set aside when the experimental dish was prepared, was put in a test tube and sterilized in the autoclave. The same amount of sterilized milk was used for comparison. Each tube was inoculated with 0.0001 c. c. of a twenty-four-hour broth culture of the typhoid bacillus isolated from Mrs. X. The tubes were thoroughly shaken and then incubated at 98.6 degrees F.

The laboratory experiments completed the explanation of the Hanford outbreak by showing that the sauce used in making the Spanish spaghetti was a good culture medium and that the dish had not been sterilized after leaving the house of the typhoid carrier.

Moreover, it was demonstrated that cooked dishes must be considered as possible conveyers of infection unless it can be shown that the method of cooking would produce complete sterilization. The slowness with which heat penetrates dishes like the Spanish spaghetti shows that very prolonged heating would be necessary for sterilization of large dishes of such food. Ordinary baking merely incubates the interior of these masses of food.



"Typhoid Mary" in a Group of Hospital Patients at North Brother Island, New York.

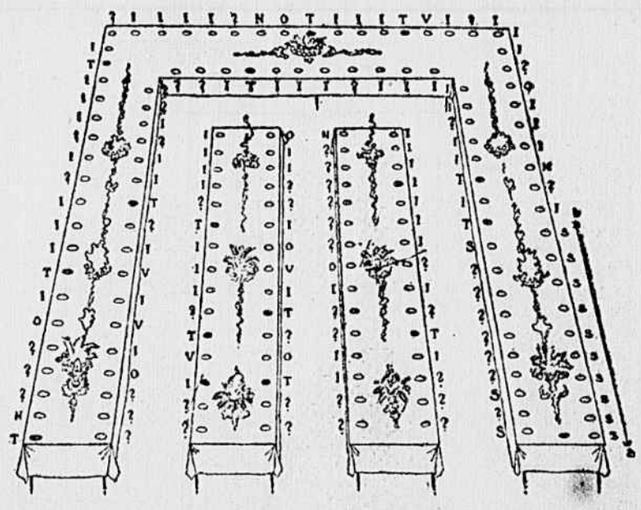


Diagram of a Banquet Table on Which Food Was Infected by a Typhoid Carrier, Showing the Average Distribution of Contagion. I, Light Cases; T, Severe Typhoid; N, Uninfected; V, Vacant; ?, Doubtful; S, Safe Food.